**Evolutionary Comparison of Aromatases in Cat Family**

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Aromatase (P450arom, CYP19A1) is a redox enzyme that plays multiple crucial roles in a mammalian system. It is a catalyst that takes part in estrogen biosynthesis as well as functions as a xenobiotic that removes drug toxicity outside the body. As a catalyst, it undergoes three-step oxidation reactions in the presence of molecular oxygen and electrons that are required for the conversion of androgens (like testosterone) to estrogens in the last step of estrogen biosynthesis. They are found to be highly specific in their reactions because they share only 15-20% sequence identity with other cytochrome P450 enzymes indicating, a unique catalytic site and higher substrate specificity. However, despite their importance in playing a vital role in estrogen biosynthesis that relates to the survival and fitness of the species during evolution, very few comparative studies have been conducted on vertebrate and/or mammalian aromatase systems. Hence, our study focuses on the evolution of aromatases observed in species like Homotherium spp., a sabre-toothed cat that walked on earth 5 million to 10,000 years ago to a domestic cat, using computational tools like Molecular Dynamics simulations and Bioinformatics. We plan to study the effect of evolution on these enzymes and understand the evolution of their structure-function relationship with the substrate. Through this investigation, we expect that we can solve the mystery of aromatases that makes them substrate-specific and highly efficient in their catalytic activity which could lead to direct potential applications in the field of new drug synthesis, targeted breast cancer therapy, and biosensor design development.